July 1, 2002

Mr. Gerard J. Thibeault, Executive Officer
California Regional Water Quality Control Board
Santa Ana Region
3737 Main Street, Suite 500
Riverside, CA 92501-3339 File#10(NPD)-2.06

RE: REQUEST FOR TECHNICAL REPORT ON BACTERIOLOGICAL IMPAIRMENTS IN THE SANTA ANA RIVER SYSTEM

Dear Mr. Thibeault:

In January 2001, the San Bernardino County Flood Control District (SBCFCD) and the Riverside County Flood Control & Water Conservation District (RCFC&WCD) met with the Santa Ana Regional Water Quality Control Board (RWQCB) to discuss the development of a technical report on the bacteriological water quality impairments of the upper Santa Ana River. It is our understanding that the RWQCB's concerns are based on several measurements of elevated bacteria concentrations in the Upper Santa Ana River. At this meeting, the RWQCB requested the development of a monitoring plan to initially assess concentrations of indicator bacteria species in the Santa Ana River.

Subsequently, the SBCFCD and the RCFC&WCD agreed to jointly develop a proposed work plan for characterizing bacteriological water quality impairments in the Upper Santa Ana River and identifying sources in the vicinity of the urbanized areas of San Bernardino and Riverside counties. The objective of this work plan is to obtain information necessary for the development of programs to control the sources that contribute to the bacteriological impairment of the Upper Santa Ana River.

Enclosed is the proposed work plan for your review. The key elements of this proposed work plan are:

1) A water quality assessment of the upper Santa Ana River to determine the extent of the bacteriological water quality impairments.

2) An identification of the most likely sources that contribute to the bacteriological impairment of the river and to assess their relative impact on the river.

Although urban runoff may be one of the sources of the elevated concentrations of bacteria, we believe there are a number of additional significant potential sources. The SBCFCD and the RCFC&WCD are also concerned about the tangible cost-implications of the RWQCB's request and that (to date) only municipal stormwater permittees have

been requested to participate in the monitoring efforts. In this regard, we are requesting the RWQCB's assistance in funding the proposed study. In addition, we are requesting the RWQCB's assistance in engaging other entities that might be responsible for significant potential sources as an effort to allow the financial burden of this plan to be equitably distributed.

To further assist the Permittees in understanding the concerns leading to the 13267 letter, a copy of the preliminary investigation prepared by the Regional Board is requested. In addition, to assist the Permittees in obtaining additional funding to support the requested studies, the Regional Board's economic justification for the requested studies is requested.

The SBCFCD and the RCFC&WCD look forward to the opportunity to meet with you to discuss our proposed work plan and alternatives for cost sharing with the Regional Board. If you have any additional questions or comments, please contact Naresh Varma at (909) 387-8110.

Very truly yours,

KEN A. MILLER, P.E.
Flood Control Engineer

KAM:NPV:jm/rwqcb_letter.doc

cc: Naresh Varma
NPDES Copermittees
RCFC&WCD
PJM Reading file

1.0 Introduction

This proposed work plan was developed in response to a request made by the Santa Ana Regional Water Quality Control Board (RWQCB) under the authority of Section 13267 of the California Water Code. The RWQCB requested:

1. A proposed monitoring plan, including time schedules, to initially assess concentrations of indicator bacteria species in the Santa Ana River and any tributary systems located directly upstream of areas with elevated bacteria concentrations; and,
2. A proposed plan, including time schedules, to identify whether the elevated concentrations of bacteria are due to human or domestic animals/wildlife sources.

The proposed work plan is a cooperative effort between the Riverside County Flood Control and Water Conservation District (RCFC&WCD) and the San Bernardino County Flood Control District (SBCFCD).

The extent of the elevated bacteria levels from point and nonpoint sources in the Upper Santa Ana River has not been identified. The extent and the sources of the significant sources of bacterial contamination must be ascertained to determine whether the elevated bacteria are due to human sources and, if so, to develop effective source control programs.

The objective of this proposed work plan is to conduct an initial water quality assessment of the Santa Ana River in those reaches in the vicinity of the urbanized areas of San Bernardino and Riverside Counties. This information will be used by the RCFC&WCD and SBCFCD to develop a plan to identify whether the elevated concentrations of indicator bacteria are due to human or domestic animals/wildlife associated with urban runoff and to assess their relative impacts on water quality.

This proposed work plan is organized into the following sections:

1.1 Statement of Problem

Elevated levels of indicator bacteria exceeding the REC-1 (Water Contact Recreation) standard have been measured at several locations in the Santa Ana River. As this indicates a potential impairment of a designated beneficial use of the Santa Ana River, the RWQCB issued a 13267 letter to the municipal permittees of Riverside and San Bernardino counties within the Santa Ana River watershed requesting a report on the elevated levels of indicator bacteria.

Traditionally, microbiological water quality is determined by measuring the concentration of bacterial indicators such as total coliform (TC) and fecal coliform (FC). However, as these bacteria are found in both human waste and animal waste and they may not be the best indicators of contamination by human waste. In order to identify whether the elevated concentrations of bacteria are due to human wastes or domestic animals/wildlife sources, the concentrations of indicator bacteria species in the Santa Ana River and tributary systems must be initially assessed. The ratio of fecal coliforms to fecal streptococci (FC/FS) has been used as an indicator of the origin of contamination. A ratio of greater than 4 is characteristic of human fecal contamination whereas a ratio of less than 0.7 suggest animal waste.

Monitoring for the presence of potential microbial pathogens is necessary to determine if the water quality is adequate for its intended use. However, the microbial pathogens that originate in the mammalian gut are difficult to isolate from water. Therefore, the presence of microbial pathogens is determined indirectly by measuring the density of two groups of indicator microorganisms known as coliform bacteria and fecal streptococci bacteria. The microbiological water quality standards established by the RWQCB in the Basin Plan for surface waters with Municipal Supply and Water Contact Recreation beneficial uses, including the Santa Ana River, are based TC and FC. These standards are 100 MPN/100 ml and log mean 200 MPN/100 ml, respectively. To control and/or eliminate the source of contamination, it is necessary to test the water for other indicator bacteria such as fecal

streptococcus. The ratio of FC to fecal streptococcus has been used to differentiate between animal waste and human waste.

The Riverside County Department of Environmental Health has collected bacteriological water quality samples on a periodic basis along the Santa Ana River within Riverside County from 1992 through 1996. The monthly monitoring results during the spring and summer periods of 1992 indicated that concentrations of fecal coliform bacteria at all of the river sampling sites exceeded the Region's Basin Plan fecal coliform microbiological standard (log mean 200 MPN/100 ml). The average fecal coliform level reported for the three-year period of 1992 through 1994 was 400 MPN/100 ml. The average fecal coliform level reported for 1996 was 560 MPN/100 ml. Collectively, these data suggest potential impairment of the REC-1 beneficial use resulting from exceedances of the water quality objective for fecal coliform bacteria at certain locations in the Santa Ana River. However, neither the extent of the elevated levels of bacteria along the length of the Santa Ana River nor the sources of the bacteria have been identified.

The RCFC&WCD and the SBCFCD maintain a number of water quality monitoring stations during storm events as well as during the dry season. As an example, in 1996 the RCFC&WCD collected over 50 samples and analyzed for fecal coliform (FC), fecal streptococcus (FS), and total coliform (TC). The reported peak concentration values were: 70,000MPN/100ml (FC); 16,000 MPN/100ml (FS); and 500,000 MPN/100ml (TC), all measured during wet weather.

There are many potential point and non-point sources that may be contributing to elevated levels of indicator bacteria species to the Upper Santa Ana River. These include:

- Runoff from various concentrated animal feeding operations and smaller agricultural operations including: dairy farms; horse stables; chicken and pig farms; goats; sheep; etc.
- Publicly Owned Treatment Works (POTWs) that discharge secondary- and/or tertiary-treated effluents into the River;
- Droppings deposited by wildlife sources (rodents, rabbits, feral cats, pigs and dogs), and resident waterfowl populations;
- Animal carcasses;
- Food and paper waste from individuals that use the river for recreational purposes;

- Urban runoff; and
- Human waste from such sources as the transient populations, sanitary sewer overflows from the sanitary collection system, and surface discharges from failed subsurface septic tank systems.

1.2 Scope

The purpose of these proposed investigative activities is to collect information and data in order to characterize the extent of the elevated bacterial concentrations and provide a preliminary identification of significant sources that contribute to these elevated concentrations in the Upper Santa Ana River. Once the extent and preliminary identification of these sources are identified, programs to further identify whether the sources are due to human or domestic animals/wildlife sources can be developed and implemented.

2.1 Review and Summarize Data

The first phase of this proposed work plan will be to collect and evaluate existing bacteriological analytical data. It is anticipated that such bacteriological data may be acquired from a number of sources including the Riverside County Department of Environmental Health, the Orange County Water District, RWQCB, United States Environmental Protection Agency's STORET database, and the RCFC&WCD's Hydron database. This data will be summarized in a Microsoft Excel spreadsheet and analyzed to determine trends, seasonal variation, and frequency of exceedances of the microbiological water quality standard. Tables that display location, sample collection date and time, bacteriological parameter and the analytical result will be prepared. To the extent possible, other field notes and supplemental data will be gathered and compiled into a single table. This table will provide information regarding sample collection date and time, location and field observation/comment. It is anticipated that this additional information may allow initial correlation with possible events that contribute to elevated indicator bacteria levels in the Santa Ana River. A report detailing the results of this subtask will be prepared and the compiled database with tables will be provided.

2.2 Reconnaissance Survey

The reconnaissance survey will consist of a field survey and a review of publicly available records for information related to potentially significant sources of bacterial contamination. Such records and documents include: aerial photos; RCFCD&WCD and SBCFCD reports regarding potential sources and transient populations; information from resource agencies

such as the Riverside/Corona Resource Conservation District and the San Bernardino Valley Water Conservation District regarding the documentation of wildlife populations in the study area; Health Department records; Building Department records; Health Department regulations regarding installation and enforcement relative to septic systems; California Office of Emergency Services sewage spill records; and RWQCB records.

Based on the data review and the record search, a field survey will be conducted of the Santa Ana River within the boundaries of the proposed study area. The proposed study area encompasses approximately 302 square miles and is bordered on the east by Seven Oaks Dam in San Bernardino County and on the west by the Prado Dam in Riverside County. The general area for this study is illustrated in Figure 1. The study area will be further defined as information regarding which upstream tributary systems of the Santa Ana River should be characterized becomes available. The purpose of this field survey is to assess the concentrations of indicator bacteria in the Santa Ana River and to provide an initial identification of potentially significant point and non-point sources that may contribute elevated levels of indicator bacteria species within the boundaries of the study area.

A report summarizing the findings of this Reconnaissance Survey will be prepared and a map(s) will be provided describing the potential sources that contribute elevated levels of indicator bacteria species and their location. The map will also identify sub-watersheds and drainage systems tributary to the Santa Ana River. The findings of this Reconnaissance Survey will be used to focus the design of subsequent Characterization Studies for point and non-point sources within the study area. Initial information regarding potential point and non-point sources that may contribute elevated concentrations of indicator bacteria within the watershed is described below in Sections 2.2.1 and 2.2.2.

2.2.1 Potential Point Sources of Bacterial Contamination

Based on preliminary results of bacteriological source investigation of the Upper Santa Ana River conducted by Orange County and other local agencies, indicator bacteria have many sources and are ubiquitous throughout the urban landscape. It is likely that there are multiple dry weather sources of these bacterial indicators, including; sanitary sewer spills and leaks, transient populations, recreational waters, domestic livestock, and wildlife.

Recreational Sources

It is known that individuals occasionally use the Santa Ana River for water contact recreation at various locations, including the Van Buren Bridge and downstream of Hamner Avenue. This recreational activity may contribute coliforms either directly (body contact) or indirectly (onshore activities). This contribution usually is in the form of accidental or deliberate defecation. As a part of this proposed work plan, these and other recreational areas along the upper Santa Ana River will be identified and evaluated.

Wastewater Discharge Sources

Wastewater treatment systems are required to ensure that the characteristics (both quantity and quality) of the wastewater discharges will not cause or contribute to impairment of beneficial uses. However, wastewater treatment operations may not always achieve compliance with effluent limits or basin plan objectives for pathogens. As a part of this proposed work plan, wastewater dischargers holding NPDES permits in the study area will be identified and samples from downstream of these locations will be collected and analyzed for indicator bacteria.

Domestic Livestock Sources

A significant population of livestock (horses, cattle, etc.) exist in both urban and rural areas of Riverside and San Bernardino Counties. In addition to being a source of fecal coliform, livestock may also be the source of *E. coli* 0157:H7, *Cryptosporidium,* and *Giardia.* There are also a number of commercial dairy farms within this watershed study area. These dairy farms are mandated by the RWQCB to contain all wastewaters, including stormwater runoff, on site. Occasionally, discharges of dairy wastewater have been observed either over-flowing or flowing through damaged containment berms. This uncontained flow of wastewater may be a significant source of fecal coliform in the Santa Ana River. Additionally, aerial deposition of particulate matter from dairy farms and other livestock facilities to the Santa Ana River is another potential source.

2.2.2 Potential Non-point Sources of Bacterial Contamination

Residential Septic Tank Sources

An effective septic tank and leach field system removes bacteria and other microbiological constituents within a square meter or two of soil. However, failing septic tank systems can introduce microorganisms into the subsurface or surface environment where they can

easily be transported to receiving streams. Failing septic tank systems can allow human pathogens to move from the toilet to adjacent surface waters within 18 hours.

There are several known septic tank/leach field systems within this watershed study area. Local environmental management departments permit and inspect septic systems upon installation. Once installed, however, there is virtually no further regulatory oversight or control. Leaking septic systems have been reported and may be sources of pathogens to some of the urban creeks within San Bernardino and Riverside Counties.

As a part of this proposed work plan, Building and Safety and Environmental Health Department records and the RWQCB complaint files will be reviewed to identify those communities or residences within the study area that are on septic systems. As these areas are identified, a status review of systems previously reported as failing will be performed. It is also anticipated that during this investigation illicit discharges of grey water may also be identified.

Transient Populations

There is a constant, though shifting, transient population that inhabits areas adjacent to the Santa Ana River. It has been observed that the degree of sanitation in the camping areas of these people is poor to non-existent. A small amount of fecal matter can contain millions of pathogenic indicator organisms. Currently, data do not exist quantifying the fecal coliform impact resulting from these encampments along the river. As a part of this proposed work plan, field surveys of transient encampments adjacent to the Santa Ana River will be conducted and identified and their potential contribution to bacteriological impairment will be assessed.

Wild Animal Sources

Wild animals present along the Santa Ana River include a wide variety of mammals including: rodents; rabbits; coyotes; feral pigs, cats and dogs; beavers; and raccoons. In addition, the area is also home to a variety of waterfowl and migratory birds. These wild animals live throughout the watershed; in remote areas, and within the urban area. Their contribution of indicator species of bacteria to the Santa Ana River may be considered background levels and may be difficult to verify. Therefore, as a part of this proposed work plan, identification of these non-point sources of indicator bacteria will provide information regarding the relative impact contributed by the various communities of wildlife.

2.3 Proposed Monitoring Program

The monitoring program should include sampling locations that provide background levels not affected by human activities. To be representative of true background levels, these sampling locations must be at least 100 ft upstream from any discharge area. A review of existing historical water quality data on these locations or the surrounding area and an initial study must be conducted to determine the background levels of these locations.

Prior to initiating sampling at additional locations, a sampling protocol will be developed. The sampling protocol will include a quality assurance/quality control program for both field and laboratory activities. Development of the sampling protocol is intended to result in a robust data set that will be adequate for statistically valid analysis.

In order to initially assess the impact of urban runoff to the Santa Ana River during dry weather conditions, nine monitoring stations will be established as part of this work plan. These sites will be located in the mainstem of the Santa Ana River in Riverside and San Bernardino Counties. Dry weather flows in the Santa Ana River in San Bernardino County consist of POTW discharges and surfacing of groundwater near the Bunker Hill barrier. Therefore, the sampling stations will be established at the following stations located where groundwater surfaces and downstream of POTW discharges to the Santa Ana River to obtain a cross section of this water quality:
The monthly dry weather monitoring stations to be monitored in San Bernardino County are:

- At Mission Zanja (between Tippacanoe Avenue & Waterman Avenue
- Near La Cadena Drive
- Downstream of RIX Wastewater Treatmant Plant

The monthly dry weather monitoring stations to be monitored in Riverside County are:

- Pueblo Street
- Mission Street in Riverside
- Van Buren Street in Riverside
- River Road in Norco

In addition, the following stations in Riverside County will be monitored quarterly:

- Highway 60 bridge
- Norco Bluffs

These sites represent urbanized portions of the Santa Ana River. These sites will be designated for routine monitoring to compare levels of indicator bacteria in to REC-1 and REC-2 standards within several reaches of the upper Santa Ana River. Monthly monitoring of indicator bacteria concentrations will be conducted for 12 consecutive months during dry weather conditions. A report summarizing these analytical results will be prepared and submitted each quarter. Attachment A provides some of the initial concepts for the sampling protocol.

2.4 Preliminary Source Identification

Based on evaluation of existing data, reconnaissance survey, and the initial assessment monitoring, a preliminary identification of sources will be developed. In this subtask potential sources will be identified and their apparent relative contribution to elevated levels of indicator bacteria species will be assessed. In addition, an initial qualitative assessment of the relative contribution of human waste to the elevated levels of bacteria will be provided.

2.5 Conclusions and Recommendations

The objective of this proposed work plan is to collect information needed to provide an initial identification of the sources of elevated concentrations of indicator bacteria in the upper Santa Ana River. The relative impacts of these sources on water quality in the upper Santa Ana River will then be assessed. Based on this information, proposed plans, including time schedules, to assess the levels of indicator bacteria and to identify whether the elevated concentrations of bacteria are due to human or domestic animals/wildlife sources will be prepared.

3.0 Schedule

Implementation of the Proposed Work Plan will take approximately 12 months and will commence within 30 days of approval by the RWQCB. A report summarizing the findings of the study will be provided within 60 days of completion of the workplan. The RCFC&WCD and the SBCFCD will provide the RWQCB with quarterly updates of progress on the activities and tasks described within this work plan until this work plan is complete.

Attachment A
Draft Sampling Protocol

Water samples will be collected in sterile bottles provided by a certified analytical laboratory and according to the Standard Methods for the Examination of Water and Wastewater(APHA-AWWA-WEF, 1998). Samples will be collected between the hours of 0700 – 1100 in order to minimize the error due to temperature variance. Temperature and pH will be field measured. These results will be recorded into a field logbook along with the field observations associated with the sample site. All sample bottles will be carefully labeled to include site location information and collection date and time. The samples will be carefully packaged in a cooler to avoid breakage or contamination, and will be shipped under Chain-of-Custody to the analytical laboratory at proper temperatures and within the six hour holding time. Duplicate samples will be collected at a frequency of ten percent. The samples will be analyzed for total coliform bacteria, fecal coliform bacteria, fecal streptococcus, and enterococci bacteria using standard methods. The samples will be analyzed by a State of California certified laboratory (Environmental Laboratory Accreditation Program -CA-ELAP). Results from the laboratory analyses including the quality assurance program and quality control activities for each parameter, as specified by the Standard Methods for the Examination of Water and Wastewater, 20^{th} ed. (1998), will be tabulated on a spreadsheet for further review and calculations.

REFERENCES

APHA-AWWA-WEF (1998). Standard Methods from the Examination of Water and Wastewater, 20th edn., ed. A.D. Eaton, L.S. Cleceri and A.E. Greenberg, APHA, Washington, DC.

American Society for Microbiology (1999). Microbial Pollutants in Our Nation's Water. Environmental and Public Health Issues.

County of Riverside Health Services Agency, Department of Environmental Health (1996). Santa Ana River: Water Quality Aspects and Hazards Related to Recreational Use.

Schmitt, R.J. and Craig W. Osenberg (1996). Detecting ecological impacts: Concepts and applications in coastal habitats. New York: Academic Press.